OFFICE OF POWER TECHNOLOGIES

Success Stories

The Superconductivity Partnership Initiative

Taking the lead in the race to commercialize high-temperature superconductor technology

The Office of Power Technologies is part of the Office of Energy Efficiency and Renewable Energy

The U.S. Department of Energy's (DOE's) Superconductivity Partnership Initiative (SPI) stands at the forefront of worldwide efforts to advance research and development of superconducting power equipment for energy transmission, distribution, and industrial use.

High Temperature Superconductors (HTS) conduct electricity with high efficiency and very little loss when cooled to liquid nitrogen temperatures. Interest in these materials has exploded since the late 1980s when they were discovered.

Highlights

- ***Multidisciplinary teams pursue parallel research to meet the diverse needs of the global electrical supply market.***
- ***Prototype applications achieve world-record performance and exceed design objectives. For example, a new motor outperformed design goals by 60%.***
- ***HTS transmission cables can achieve three to five times the power capacity of conventional cables with considerably less power loss.***
- ***HTS can enhance the efficiency of electricity generation, transmission, storage, and industrial use.***
- ***Superconducting products have a potential world market of $100 billion by the year 2020.***

The SPI combines product developers with HTS manufacturers, end users, and national laboratories into integrated teams. These teams are leading the world in developing energy efficient applications. The following SPI projects have been underway for a number of years.

Rockwell Automation is leading a team to commercialize large industrial HTS motors. This team built and tested a 200-horsepower (hp) motor (a world record) and is designing and building a 1000- and 5000-hp motor. The 5000-hp HTS motor is expected to be half the size and half the weight of a conventional motor, and to be 98% efficient. (Conventional high efficiency motors are 96% efficient.)

General Atomics leads a team developing current controllers to help protect utility equipment, improve reliability, and increase

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Superconducting-wire manufacturers are now able to produce kilometer-length, high-quality HTS wire.

Project Partners

U.S. Department of Energy

ABB Inc. Power & Distribution Company

Air Products and Chemicals

American Superconductor

Argonne National Laboratory

Boeing

Centerior Energy

Detroit Edison

DuPont Company

Electric Power Research Institute

General Atomics

Intermagnetics General Corporation

Los Alamos National Laboratory

Oak Ridge National Laboratory

Pirelli Cable Corporation

Rockwell Automation

Sandia National Laboratories

Southern California Edison

Southwire Corporation

Waukesha Electric Systems

stability of the utility distribution grid. This team successfully demonstrated a 2.4-kilovolt unit and is fabricating a 15-kilovolt unit that will be demonstrated in a Southern California Edison substation.

Pirelli Cable Corporation is developing an underground transmission cable that could be used to retrofit existing cables in utility conduits and double the power capacity. Pirelli developed a 50-meter cable system and is now developing a 120-meter cable that will be installed in the Detroit Edison utility system.

Because of the success these companies have had, and the progress they continue to make, DOE has expanded the SPI program to include five additional projects (see table).

Before the benefits of superconductivity can be realized, the SPI must still address the questions of cost, alternating current losses, and development of reliable superconducting wires. Although HTS materials hold the promise of expanding electrical capacity and efficiency, they also represent new technology, and electric utilities will need to analyze all aspects of their use. Despite these challenges, the global market for superconducting products might reach as high as $100 billion by the year 2020.

TEAM LEADER	APPLICATION
Southwire Corporation	HTS Transmission Cable
Waukesha Electric Systems	HTS Transformer
ABB Inc. Power & Distribution Company	HTS Transformer
Dupont Company	HTS Magnetic Separator
Boeing Storage	Flywheel Energy

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Recent information is regularly posted on the program's Web site at:
www.eren.doe.gov/superconductivity

Daley, James G., and Platt, Christine E. "The DOE's Superconductivity Partnerships." *Superconductor Industry* (1:1997), pp. 24-27, Spring 1997.

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